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(54) **METHODS AND SYSTEMS FOR DETECTING, MEASURING, AND MONITORING STRESS IN SPEECH**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,367,454 A * 11/1994 Kawamoto et al. 715/706
5,539,860 A * 7/1996 DeSimone et al. 704/234
5,647,834 A * 7/1997 Ron 600/23
5,987,415 A * 11/1999 Breese et al. 704/270
6,006,188 A * 12/1999 Bogdashevsky et al. 704/270
6,151,571 A * 11/2000 Pertrushin 704/209
6,173,260 B1 * 1/2001 Slaney 704/250
6,463,415 B2 * 10/2002 St. John 704/273
2003/0033145 A1 * 2/2003 Petrushin 704/236
2003/0078768 A1 * 4/2003 Silverman et al. 704/206

* cited by examiner

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(57) **ABSTRACT**

As disclosed herein, the present invention provides methods and systems for detecting, measuring, or monitoring the presence of absence of at least one emotion in a subject from a speech sample obtained from the subject. In particular, the methods and systems of the present invention comprise extracting at least one feature from the speech sample, assigning the speech sample a score using a weighted frequency band scoring scheme, and comparing the score with a general reference model or a control. As disclosed, the methods, systems and computer programs of the present invention provide detection error rates of about 4.7% or less, preferably about 3.0% or less, more preferably about 2.0% or less, most preferably about 1.0% or less and thereby reduced the detection error rate by about 60.0% or more, preferably about 70.0% or more, more preferably about 80.0% or more, even more preferably about 90% or more, and most preferably 95.0% or more than the detection error rates of prior art methods.

39 Claims, 4 Drawing Sheets